

Report Cover

Test Report Number: 00AYP028 **Test Report Date:** 18 Aug 00

Previous Report(s): 98AYP622 **Previous Report Date(s):** 18 Dec 98

Title: Performance Oriented Packaging Testing of a
Grade V3c Fiberboard, Style RSC Box, 12- by 12- by
16-inches (ID), with 5.5-Liter Friction Plug (Lid), Round,
Metal Cans (Qty of 1) with *I.C.C. LTD* Brand Ring and
Containing 1-Liter, Round, Glass Bottle (Qty of 1)
for Liquids

Performing Activity: LOGSA Packaging, Storage,
and Containerization Center
ATTN: AMXLS-T
11 Hap Arnold Boulevard
Tobyhanna, PA 18466-5097

Responsible Individual: Francis S. Flynn

Performing Activity's Reference(s): 9HTNR; AMC 13-88

Requesting Organization(s):
Defense Logistics Agency
Defense Distribution Center
ATTN: DDC-TO
2001 Mission Drive
New Cumberland, PA 17070

Requesting Organization's Reference(s):
1. Memorandum, DLA, 14 Oct 99

Test Results: ____ single X combination ____ composite

Section I. Pre-test Conditions

For initial testing, a bundle of boxes was received in new condition. Boxes from the lot from which this box was taken have also been performance tested with a variety of bottles and cans. New rings were received from the supplier/manufacturer. Cans were taken from stock.

The following identification schema designates the packaging specimen used for the test(s) indicated. Assignments were made at random, in no particular order of sequence.

<u>Specimen No(s).</u>	<u>Test</u>
1	repetitive-shock vibration test flat onto bottom, drop test flat onto top, drop test flat onto long side, drop test flat onto short side, drop test bottom joint corner, drop test
2	stack test
3	water resistance test

Test Results: (continued)

Section II. Summary

	<u>SPECIMEN</u>	<u>ALL</u>
A. Drop test - 1.8 m (PG I SG 1.2, PG II SG 1.8, PG III SG 2.7)		PASS
flat onto the bottom (face 3)	PASS	
flat onto the top (face 1)	PASS	
flat onto long side (face 4)	PASS	
flat onto short side (face 6)	PASS	
top corner (2-3-5)	PASS	
B. Stacking test - static load, 500 lb, 24 hr		PASS
C. Vibration standard - repetitive-shock, rotary motion 3.53 Hz., 1 hr		PASS
D. Leakproofness test - restrained under water/soap over seams		N/A
production testing, 20 kPa, 5 min.	N/A	
design qualification, 20 kPa, 5 min.	N/A	
salvage drum requirement, 20 kPa, 5 min.	N/A	
E. Internal pressure test/Hydrostatic pressure test (liq.) -		N/A
F. Water resistance test (fiberboard box) -		PASS
G. Compatibility test (liq. in plastics) -		N/A

To be certifiable, the configuration must pass the applicable tests for the type packaging, intended lading, and mode(s) of shipment. This report is applicable to transportation by air.

Test Results (continued)**Section III. Discussion**

Note. Numeric designations denote which specimen tested in that orientation.

A. Drop test: 49 CFR §178.603

- ☐ cold conditioned (0° F, 72 hr)
☒ ambient conditions (~72° F)
☐ standard conditions (50% RH & 23° C)

No.	Ht.	Orientation	Results
1 ¹	71"	Flat onto box bottom	Pass. No leaks/rupture; entire contents retained
1 ¹	71"	Flat onto box top	Pass. No leaks/rupture; entire contents retained
1 ¹	71"	Flat onto box long side	Pass. No leaks/rupture; entire contents retained
1 ¹	71"	Flat onto box short side	Pass. No leaks/rupture; entire contents retained
1 ¹	71"	Diagonally onto bottom, joint corner	Pass. No leaks/rupture; minor crushing of the 5-2-3 corner; can retained completely within the box; absorbent material had not settled.

Note 1. Specimen 1, a combination packaging consisting of a grade V3c fiberboard box (outer packaging) containing a secondary inner packaging (one 5.5-L, friction plug metal can, fitted with an I.C.C. LTD ring). The glass primary inner packaging inside the can, was filled with water (SG 1.0) to 98% of maximum capacity (based on weight).

B. Stacking test: See 49 CFR §178.606. (Conducted under 00AYP040)

- ☐ standard conditions (23° C & 50% RH)
☒ ambient conditions (~72° F)
☐ high temperature conditions (104° F)

No.	Length	Type	Load/Force	Peak Force	Results	Stability Maintained?
2 ¹	24 hr	Static	500 lbf	N/A lbf	Pass	Yes

Note 1. Specimen 2, grade V3c fiberboard box, tested empty

C. Vibration test: See 49 CFR §178.608.

No.	Frequency	Duration	Results
1 ¹	3.53 Hz	1 hr	Pass. No leakage, rupture, or damage

Note 1. Specimen 1, a combination packaging consisting of a grade V3c fiberboard box (outer packaging) containing a secondary inner packaging (one 5.5-L, friction plug metal can, fitted with an I.C.C. LTD ring). The glass primary inner packaging inside the can, was filled with water (SG 1.0) to 98% of maximum capacity (based on weight).

Test Results: Section III (continued)

D. Leakproofness test: 49 CFR §178.604

N/A. Leakproofness testing of inner packagings in combination packagings is not required.

E. Internal Pressure/Hydrostatic Pressure test: 49 CFR §178.605

Testing for the maintenance of internal pressure is not required for combination configurations for surface modes. For transportation by air, 49 CFR §173.27 applies. Testing was actually accomplished by a third-party laboratory (DDL, Inc.), on behalf of the I.C.C. LTD brand ring manufacturer (International Compliance Center LTD). A test report (No. 980143) was provided. The rings had been tested with 3 each 5.5-liter cans provided by the supplier (I.C.C. LTD).

Based on the reported test results, the 5.5-liter friction lid cans, when equipped with the I.C.C. LTD brand ring (no substitution authorized), are capable of maintaining the minimum internal pressure required for transportation by aircraft.

F. Water resistance (Cobb Method) test (fiberboard): As required by the standards for fiberboard boxes (49 CFR §178.516), the Cobb Method Test for water absorptiveness was performed on specimens cut from two boxes (specimen 3) taken from the same bundle as the box used for rough handling (drop, stack, and vibration) testing.

No. specimens felt side (exterior) 5. Average 116.6 g/m².
Standard deviation 3.44. Highest exterior value was 120.0 g/m².

Lowest exterior value was 112 g/m². All of the samples tested were free of printing.

No. specimens wire side (interior) 5. Average 127.40 g/m². Standard deviation 9.53. Highest interior value was 144.0 g/m². Lowest interior value was 120.0 g/m².

No. specimens exceeding 155 g/m² 0.

It should be noted that improper storage and rough handling may break the fibers and abrade the coating of the box, decreasing its ability to resist water absorption. This could result in higher test values. Since boxes are occasionally made with the wire facing (interior) as the exterior side of the box, specimens from both the wire (interior) and the felt (exterior) facings were tested for water absorptiveness.

G. Compatibility test (plastics packagings only): N/A

Compatibility testing (a procedure specified in appendix B to part 173, as required by 49 CFR §173.24(e)(3)(ii)) is only required for plastics packagings intended to contain *liquid* hazardous materials.

Test Results: (continued)

Section IV. Notes

Unless the friction-lid can is equipped with the I.C.C. LTD brand locking ring, this configuration is not applicable to the transportation of liquids by air.

For this configuration, one of the following can be used without any notable difference in performance:

- 1) Fine grade vermiculite (CID A-A-52450, Vermiculite, Absorbent (For Packaging Liquid Hazardous Materials))
- 2) "HAZMATPAC® Absorbent A-900"
- 3) "Absorption Corporation Absorbent GP"

Note: Inner packagings have a tendency to migrate if the loose fill material is not firmly packed, especially into the box corners.

Test Personnel

The personnel who performed the aforementioned testing, or had a role in the testing, evaluation, and/or documentation, as reported herein are recorded in the test files.

References

- A. Title 49 Code of Federal Regulations, Parts 106 and 180,** Spring 2000, current as of 14 Jan 00
- B. International Air Transport Association Dangerous Goods Regulations,** 39th edition, 1 January 1998
- C. ASTM D 4919,** Specification for Testing of Hazardous Materials Packagings
- D. ASTM D 999,** Standard Method for Vibration Testing of Shipping Containers

E. ASTM D 951, Standard Test Method Water Resistance of Shipping Containers by Spray Method

F. TAPPI Standard: T 441 Water Absorptiveness of Sized (Non-Bibulous) Paper and Paperboard (Cobb Test)

G. Recommendations on the Transport of Dangerous Goods, sixth revised edition, United Nations, New York, 1990

H. DLAD 4145.41/AR 700-143/AFJI 24-201/NAVSUPINST 4030.55A/MCO 4030.40A, Packaging of Hazardous Material, 23 Jul 96

Equipment

Item	Manufacturer	Serial No.	Calibration Expiration Date
1,250-lb vibration table	L.A.B Skaneateles, NY	8120179	<i>see note</i>
drop tester	L.A.B Skaneateles, NY	3811	N/R

Note. Equipment is calibrated in accordance with International Safe Transit Association test equipment verification requirements.

Appendix A

Test Applicability

Pass/fail conclusions were based on the particular ring, friction-lid can, bottle, and box specimens, test loads, and the limited quantities submitted for test. Extrapolation to other materials, other manufacturers, other applications, different inner packagings, container sizes, or lesser inner quantities is the responsibility of the packaging design agency or applicable higher headquarters. Extrapolation of test results based on less than the minimum recommended number of test specimens is also the responsibility of the packaging design agency or applicable higher headquarters. Extrapolation of test results to other locking ring brands is not authorized.

Reference to specification materials has been made based either on the information provided by the requester, the manufacturer, or the markings printed on, attached to, or embossed on the packagings. It was not possible to identify the exact composition of the box construction materials.

Testing was performed per *Title 49 Code of Federal Regulations; Subtitle B, Other Regulations; Chapter I, Research and Special Programs Administration (DOT); Subchapter C, Hazardous Materials Regulations; Part 173, Shippers- General Requirements for Shipments and Packagings; Part 173 Subpart A, General; as well as, Part 178, Specifications for Packagings; and Part 178 Subpart M, Testing of Non-Bulk Packagings and Packages.*

Performance testing was undertaken and completed at the request of an agency responsible for shipment of the dangerous good(s). The completion of successful required performance tests does not, by itself, authorize the marking and transportation of the dangerous good(s). Applicable modal regulations should be consulted concerning the relationship of performance testing completed and the dangerous good(s).

The required performance tests are intended to evaluate the performance of the packaging components. The criteria used to evaluate packaging performance is whether the contents of the packaging are retained within the outer packaging, should damage to the outer packaging occur, and secondly, if any inner packaging of hazardous materials leaks, ruptures, or is damaged so as to affect transportation safety. The successful completion of the required tests does not ensure the undamaged delivery or survivability of the actual commodity/item. Separate testing is necessary to assure the stability of any explosive item.

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Appendix A (Continued)

Before a configuration can be certified by the person(s) authorizing shipment, the appropriate packaging for the particular hazardous lading and mode of transportation must be determined, and the item(s) must be prepared for shipment per applicable regulations. The chosen configuration must have been performance tested in accordance with the size, the shape, and the weight constraints posed by the configuration to be certified. The testing reported herein should not be construed as blanket certification of any configuration that

simply uses the performance tested box, or a friction-lid can with a locking ring. Packaging paragraphs apply.

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Appendix B

Test Data Sheet Section I. Test Product

Physical State: ☐ solid ☒ liquid ☐ gas ☐ aerosol

Name: Water

Amount Per Container (Configuration):

1 liter, rated
2.20 lb
3.20 lb, packed

Gross Weight: 22.28 lb; 10.13 kg

Density/Specific Gravity: 1.0

Section II. Test Parameters

Drop Height: Ref: 49 CFR §178.603

☒ 1.8 m; 71 in. (PG I, II, & III, SG = 1.2 or solids)
☐ 1.2 m; 47 in. (PG II & III, SG = 1.2 or solids)
☐ 0.8 m; 32 in. (PG III, SG = 1.2 or solids)
☐ m; in. (other, PG , SG)
from-- ☒ PG I: SG x 1.5 m, SG x 59.06 in.
 ☒ PG II: SG x 1.0 m, SG x 39.37 in.
 ☒ PG III: SG x 0.67 m, SG x 26.38 in.

Unless otherwise computed for more dense liquids, water (SG = 1) represents a solution having a specific gravity of 1.2 or less. Equivalent specific gravity derived from drop height as follows--

PG factor x density (or SG) = drop height, thus
SG = drop height/PG factor (49 CFR §178.603)
0.67 m x SG = 1.8 m, thus SG = 2.7, PG III

Internal Pressure/Hydrostatic Pressure (liquids only):

250 kPa (36 psi); PG I single minimum

[49 CFR §178.605(d)(3), surface & 49 CFR §173.27(c)(3)(ii), air]

☐ 100 kPa (15 psi); PG II/III single minimum

[49 CFR §178.605(d)(3), surface & 49 CFR §173.27(c)(3)(ii), air]

☐ 80 kPa (12 psi); PG III of Class 3 or Division 6.1 sgl min.

[49 CFR §173.27(c)(3)(ii), air]

☒ 95 kPa (14 psi); **inner/supplementary minimum, PG N/A**

[49 CFR §173.27(c)(2)(i), air]

☐ 75 kPa (11 psi); inner/suppl. min., PG III of Cl 3/Div 6.1

[49 CFR §173.27(c)(2)(i), air]

☐ 15 psi/103.4 kPa; other, drum specification [MIL-D-6054]

☐ kPa/psi; other, _____

Stacking Weight Formula, Liquids - DLA

Variables	Inputs	Calculations
h height, drum/box	16.25	
n # stacked containers	XXXXXXXXXX	7.26
w1 weight, drum/box	2.2	2.2
w2 weight, bottle/can	0.88	0.88
w3 weight, inner container	1.0	1.0
q1 # inner containers	1	1
v1 max. volume, 1 inner container	0.26	0.26
v total volume	XXXXXXXXXX	0.26
w4 weight, item (unpacked)	2.2	2.2
W5 weight, absorbent	16	16
W total weight	XXXXXXXXXX	22.28
C constant	1	
A1 Stacking weight-PG I	XXXXXXXXXX	155.4
A2 Stacking weight-PG II	XXXXXXXXXX	163.3
A3 Stacking weight-PG III	XXXXXXXXXX	175.2
A11 Stacking weight, rounded-PG I	XXXXXXXXXX	156
A21 Stacking weight, rounded-PG II	XXXXXXXXXX	164
A31 Stacking weight, rounded-PG III	XXXXXXXXXX	176

NOTE: A1 = $(n-1) \cdot (w + (1.2 \cdot v \cdot 8.3 \cdot 0.98)) \cdot (c)$, Packing Group I
A2 = $(n-1) \cdot (w + (1.8 \cdot v \cdot 8.3 \cdot 0.98)) \cdot (c)$, Packing Group II
A3 = $(n-1) \cdot (w + (2.7 \cdot v \cdot 8.3 \cdot 0.98)) \cdot (c)$, Packing Group III

A1 = stacking weight in pounds, PG I
A2 = stacking weight in pounds, PG II
A3 = stacking weight in pounds, PG III

n = $(118/h)$, minimum number of containers that when stacked, reach a height of

3 m

w = $w1 + (w2 \cdot q1) + (w3 \cdot q1) + w5$, total weight in pounds

v = $v1 \cdot q1$, total volume

C = either 1.5 (the compensation factor that converts the static load of the stacking test into a load suitable for dynamic compression testing),
or 1.0 (static top load)

Appendix B (Continued)**Section III. Equivalencies of Liquids**

	Specific Gravity ¹	Total (Each) Amount per Container	Gross Weight (pounds)	(kilograms)
water	1.0	2.20 (2.20) lb	22.38	10.13
PG I	1.2	2.64 (2.64) lb	22.72	10.32
PG II	1.8	3.96 (3.96) lb	24.04	10.92
PG III	2.7	5.94 (5.94) lb	26.02	11.83

Note 1. Equivalent specific gravity derived from drop height as follows-- PG factor x density (or SG) = drop height, thus

$$SG = \text{drop height} / \text{PG factor (49 CFR §178.603)}$$

PG I: 1.5 m x SG = 1.8 m, thus SG = 1.2

PG II: 1.0 m x SG = 1.8 m, thus SG = 1.8

PG III: 0.67 m x SG = 1.8 m, thus SG = 2.7

Unless otherwise computed for more dense liquids, water (SG = 1) represents a solution having a specific gravity of 1.2 or less.

Appendix C

Packaging Data Sheet

Section I. Exterior Shipping Container

Packaging Category: ____ single X combination ____ composite

UN Type: Fiberboard boxes (49 CFR §178.516) UN Code: 4G

Specification Type(s):

- (1) Fabrication of Fiberboard Shipping Boxes
- (2) Corrugated and Solid Fiberboard Sheet Stock (Container Grade) and Cut Shapes
- (3) Box, Shipping, Fiberboard (canceled Mar 94)
- (4) Fiberboard: Corrugated and Solid, Sheet Stock (Container Grade), and Cut Shapes [canceled Mar 94]

Specification Number(s):

- (1) ASTM D 5118, style RSC (regular slotted container)
- (2) ASTM D 4727 (marked), grade V3c (marked), type CF, variety SW, class (domestic/weather-resistant) not marked
- (3) Equivalent to-- PPP-B-636, style RSC [canceled Mar 94]
- (4) Equivalent to-- PPP-F-320E, type CF (corrugated fiberboard), variety SW (singlewall), grade V3c, class (domestic/weather-resistant) not marked, [canceled Mar 94]

Container Manufacturer:

Lynchburg Sheltered Industries Lynchburg Sheltered Industries
Lynchburg, VA (boxmaker's seal) Lynchburg, VA 24501 (box flap)

Date of Manufacture: 8-98 (marked)

Manufacturer's Reference Number(s): N/A

Material: Corrugated fiberboard, glued manufacturer's joint

"bursting test 350 lbs per sq inch"

"min comb wt facings 180 lbs per sq in"

"size limit 100 inches"

"gross wt lt 120 lbs"

"min. avg. burst. stgth. in excess of ____ lbs. p.s.i." - N/A

NSN: 8115-00-418-4653

Tare Weight: 2.2 lb

Dimensions: 12 in. by 12 in. by 16 in. ID (marked)

Box Contract No.: Not marked

Purchase Order No.: Not marked

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Appendix C (Continued)

Section I. Exterior Shipping Container (continued)

Closure Specification(s): ASTM D 1974, Methods of Closing,
Sealing, and Reinforcing Fiberboard Shipping Containers

Closure Type: Pressure-sensitive, film-backed tape

Closure Type Specification(s):

- (1) Tested-- Commercial Item Description
Tape, Film, Pressure-Sensitive Adhesive, (Box Closure)
[canceled Dec 95]
- (2) Equivalent to-- FED SPEC
Tape: Packaging, Waterproof [canceled Dec 95]
- (3) Equivalent to-- ASTM Specification for Pressure-Sensitive
Tape for Packaging, Box Closure and Sealing

Closure Type Specification Number(s):

- (1) A-A-1830A (marked) [canceled Dec 95]
- (2) PPP-T-60, type III (film backing), class 2 (transparent)
[canceled Dec 95]
- (3) ASTM D 5486, type I (waterproof, weather-resistant,
polyester-backed), class 2 (transparent)

Closure Type NSN: 7510-00-266-6715

Closure Method: Tape applied over all seams, corners, and
joints of the box. Tape applied to the manufacturer's joint
shall cover the joint, but not extend beyond the corners. The
tape applied to the seams shall be centered over the seams and
shall extend over the corners and edges of the box a minimum
of 2½ inches onto the adjacent box panels.

Closure Method Specification: ASTM D 1974 *sealing method B*;
formerly method V, PPP-B-636 appendix (7-strip method)

Closure Dimensions: 2-inch (tape width)

Closure Manufacturer/Distributor:

American Tape	SETAPE, INC.
Secaucus, NJ (core marked)	Jacksonville, FL (wrapper marked)

Closure Date of Manufacture: 2/97 (marked)

Closure Contract No.: GS-141-63159 (box marked)
Purchase Order No.: A-W-LE486-9E (box marked)

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Section I. Exterior Shipping Container (continued)

Reinforcement Type(s): Tape Banding

Reinforcement Specification(s) and Number(s): ASTM D 1974,
Methods of Closing, Sealing, and Reinforcing Fiberboard
Shipping Containers

Reinforcement Specification Method No(s): ASTM D 1974,
modified Reinforcement Method 2B (see Reinforcement Method)

Reinforcement Method(s): Tape applied 1 inch from each end of
the box. Bands shall overlap onto themselves at least
3 inches. Modifications-- 1-inch-wide tape used instead of
 $\frac{3}{4}$ -inch-wide tape; four bands instead of one band; medium
tensile tape used instead of high tensile tape

Banding Specification Type(s):

- (1) Tested (marked)-- Commercial Item Description
Tape, Pressure-Sensitive Adhesive, (Medium Tensile
Strength, Glass Filament, Reinforced Tape) [canceled Jan 96]
- (2) Equivalent to-- FED SPEC
Tape, Packaging/Industrial, Filament Reinforced [canceled Jan 96]
- (3) Equivalent to-- ASTM Standard Specification for
Pressure-Sensitive Tape for Packaging, Filament-Reinforced

Banding Specification Number(s):

- (1) A-A-1687B, Amendment 1 (marked) [canceled Jan 96]
- (2) PPP-T-97, type II (medium tensile), class B (transparent) [canceled Jan 96]
- (3) ASTM D 5330-93, type II (medium tensile)

Banding NSN: 7510-00-582-4772

Banding Dimensions: 1 inch (wide)

Banding Position(s): See Additional Description

- 2 girthwise tape bands, *encircling top, bottom, and sides,*
1 inch in from each end
- 2 lengthwise tape bands, *encircling top, bottom, and ends,*
1 inch in from each side
- 0 horizontal tape bands, *encircling sides and ends,*

centered around the box body

Banding Manufacturer(s):	Date of Manufacture:	12/96 (box marked)
RJM MFG./TARA TAPE (box marked)		
TARA TAPE (wrapper marked)	Contract No.:	TC-GS-14F-63238
Fairless Hills, PA 19030	Purchase Order No.:	A-W-LC337-5E

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Section I. Exterior Shipping Container (continued)

Cushioning/Dunnage: Absorbent material (approx. 16 lb inside box)

Cushioning/Dunnage Specification Type(s):

Note. Recommended use-- Commercial Item Description,
Absorbent material (For Packaging Liquid Hazardous Material)
Fiberboard-- Standard Specification for Corrugated and Solid
Fiberboard
Sheet Stock (Container Grade) and Cut Shapes

Cushioning/Dunnage Specification Number(s):

Recommended use-- A-A-52450, NSN: 8135-01-324-2664
Fiberboard-- ASTM D 4727, type CF (corrugated fiberboard)
variety SW (singlewall), C flute, class WR (weather-resistant), grade V3c

Cushioning/Dunnage Dimensions: see Additional Description

Absorbent material-- Grade 3, ASTM C 516

Cushioning/Dunnage Manufacturer(s):

Static Electricity Protection: To be determined

Additional Description:

a. More than two inches (~2¼ in.) of loose-fill absorbent material was placed in the bottom of the box. The can was placed on the absorbent, and more loose-fill absorbent material was then firmly packed around and over the can. More than two inches (~2¾ in.) of firmly packed loose-fill absorbent material covered the ring-fitted can. More than two inches (~2¾ in.) of loose-fill absorbent material separated the can from the sides and ends of the box. The loose-fill absorbent material must be firmly packed into the box corners, and must completely fill the box. Void space is not acceptable.

b. Before closing, the box was "shaken down" to settle the absorbent material. Additional absorbent material was added, as necessary to make a tight pack.

c. The quantities of absorbent material DO meet the 0.5-L guidelines for absorbent material as outlined in AFJMAN 24-204/TM 38-250/NAVSUP PUB 505/MCO P4030.19F/DLAM 4145.3, Preparing Hazardous Materials for Military Air Shipments.

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Section I. Exterior Shipping Container (continued)

d. When used, care must be exercised when selecting absorbent material to avoid introducing water or surfactants (treatments to reduce dust) into the package. Only untreated absorbent material should be used.

e. Before cancellation, PPP-B-636 specified that *horizontal* reinforcing tape bands (*encircling the box sides and ends*), are not required when the box depth (height) is less than but not equal to 18 inches. Experience has demonstrated that glued manufacturers' joints have potential to fail if horizontal reinforcing tape banding is not applied.

f. Before cancellation, PPP-B-636 specified that one *girthwise* reinforcing tape band (*encircling the box top, bottom, and sides*), is required when the box length is less than but not equal to 20 inches. Two reinforcing tape bands in the girthwise direction were used per instructions from the requesting organization.

g. Before cancellation, PPP-B-636 specified that one *lengthwise* reinforcing tape band (*encircling the box top, bottom, and ends*), is required when the box width is greater than 9 inches and less than 18 inches. Two reinforcing tape bands in the lengthwise direction were used per instructions from the requesting organization.

h. ASTM D 1974 recommends that, when used, tape bands shall be placed around the girth (smallest circumference) of the box with at least one band for each 15 inches of box length.

i. Prior to 3 March 1994, PPP-B-636 specified the construction, closing, and reinforcing of fiberboard boxes, while PPP-F-320 specified the fiberboard. Both FED-SPECs have been canceled and replaced with ASTM documents. ASTM D 4727 is the specification for fiberboard; ASTM D 5118 is the practice for fabricating fiberboard boxes; and ASTM D 1974 is the practice for closing, sealing, and reinforcing fiberboard boxes. The three ASTM documents almost mirror the two FED SPECs with the most notable exception being that PPP-B-636 provided tables for when and what size reinforcement was to be specified. ASTM D 1974 does not recommend comparable reinforcements.

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Appendix C (Continued)

Section IIA. Secondary Inner Packaging of Combination Packaging Applicable/~~Not applicable~~

Quantity of Inner Containers: 1 Capacity: 5.5 liters each

Specification Type and No(s): N/A NSN: N/A

Type: 5.5-liter unlined paint can without metal hand bail;
friction plug (lid)

Manufacturer/Distributor: The Compliance Center™)International
Compliance Center LTD)
Niagara Falls, NY (box marked)

Manufacturer/Distributor Part Number(s): can-- MT-PC5.5L
bail-- N/A
lid-- N/A

Contract and Purchase No(s): Not marked

Material(s): Steel, tin plate Date(s) of Manufacture: N/A

Tare Weight (empty can): 0.88 lb
0.40 kg

Dimensions: 6? in. - diameter (OD)
10? in. - height (OD)

Closure Type: Friction plug

Closure Method: See Additional Description

Closure Specification and Number(s): N/A

Closure Dimensions: 5½ in. (opening)

Closure Manufacturer/Distributor and Part No(s).: N/A (included w/body)

Secondary Closure: Plastic locking ring

Secondary Closure Specification(s): I.C.C. LTD proprietary

Secondary Closure Specification Number(s): NSN-- N/A

Secondary Closure Dimensions: N/A

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Appendix C (Continued)

Section IIA. Secondary Inner Packaging (continued)

Secondary Closure Manufacturer(s) and Part No(s).: I.C.C. LTD; CJ2

Secondary Closure Contract No.: N/A

Secondary Closure Purchase Order No.: N/A

Secondary Closure Date of Manufacture: Not identified

Cushioning/Dunnage Type: *see Appendix C, Section I*

Cushioning/Dunnage Specification Type and Number(s): N/A

Cushioning/Dunnage Dimensions: N/A

Cushioning/Dunnage Manufacturer: N/A

Static Electricity Protection: N/A

Additional Description: **This test report can only be cited when a I.C.C. LTD CJ2 ring is applied to the can.**

The can is to be closed using a rubber mallet to tap the entire friction lid securely in place. The plastic locking ring is then placed on top of the can. The plastic ring is installed by using a rubber mallet to tap the entire ring over the upper edges of the can. Care must be exercised to avoid denting or creasing the friction-lid can.

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Appendix C (Continued)

Section IIB. Primary Inner Packaging of Combination Packaging Applicable/~~Not applicable~~

Quantity of Inner Containers: 1

Nominal Capacity per Inner Container: 1 liter (1 qt)

Specification Type and Number(s): N/A

NSN: N/A

Type/Materials: Round, clear flint glass

Manufacturer/Distributor: Codes embossed on bottom
W W W W

1 10 13 6

Note. Each W was encircled

Date of Manufacture: N/A

Tare Weight (empty): 1 lb

Dimensions: 8¼ in. in height (OD)
3¾ in. in diameter (OD)

Closure (Method/Type): Plastic screw cap
(black phenolic, polyvinyl flat disc lining)

Closure Specification Number(s): N/A

Closure Manufacturer/Distributor and Part No(s).: N/A

Closure Dimensions: 33-400 screw-cap

Secondary Closure: Filament-reinforced tape (1 pc)

Secondary Closure Specification(s):

- (1) Tested (marked)-- Commercial Item Description
Tape, Pressure-Sensitive Adhesive, (Medium Tensile
Strength, Glass Filament, Reinforced Tape) [canceled Jan 96]
- (2) Equivalent to-- FED SPEC
Tape, Packaging/Industrial, Filament Reinforced [canceled Jan 96]
- (3) Equivalent to-- ASTM Standard Specification for
Pressure-Sensitive Tape for Packaging, Filament-Reinforced

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Appendix C (Continued)

Section IIB. Primary Inner Packaging (continued)

Secondary Closure Specification Number(s):

- (1) A-A-1687B, Amendment 1 (marked) [canceled Jan 96]
- (2) PPP-T-97, type II (medium tensile), class B (transparent) [canceled Jan 96]
- (3) ASTM D 5330-93, type II (medium tensile)

Secondary Closure NSN: 7510-00-582-4772

Secondary Closure Dimensions: 1 inch wide

Secondary Closure Manufacturer(s):

RJM MFG./TARA TAPE (box marked)

TARA TAPE (wrapper marked)

Fairless Hills, PA 19030

Secondary Closure Contract No.: TC-GS-14F-63238

Closure Purchase Order No.: A-W-LC337-5E

Secondary Closure Date of Manufacture: 12/96 (box marked)

Cushioning/Dunnage: Absorbent material (approx. 1 lb inside can)

Cushioning/Dunnage Specification Type(s):

Absorbent material-- not identified

Note. Recommended use-- Commercial Item Description,
Absorbent material (For Packaging Liquid Hazardous Material)

Cushioning/Dunnage Specification Number(s):

Absorbent material-- not identified

Recommended use-- A-A-52450, NSN: 8135-01-324-2664

Cushioning/Dunnage Dimensions: see Additional Description

Absorbent material-- Grade 3, ASTM C 516

Cushioning/Dunnage Manufacturer(s):

Absorbent material-- not identified

Static Electricity Protection: N/A

Additional Description: The screw-cap bottle is to be wrapped with enough "bubble wrap" to prevent any movement of the screw-cap bottle. Additional "bubble wrap" is to be put inside the friction-lid can, as necessary to make a tight pack. The "bubbles" are to be to the outside (i.e., the flat side is to be against the screw-cap bottle).

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Appendix D

Rationale

The equivalent of Packing Group I (great danger) testing was requested for a 12- by 12- by 16-inch corrugated fiberboard box

having as the intended contents one 1-liter, round, glass bottle, packed inside one 5.5-liter, friction plug (lid), round, metal can, fitted with a plastic locking ring. The friction-lid can is more commonly known as a paint can. The configuration to be tested is intended to be applicable to a large assortment of liquid products contained in round, glass bottles, to be packed in friction plug (paint), metal cans for transportation by air. The primary inner packaging (screw-cap bottles) can be in volumes of 1-liter or less. For lesser volumes, variations to testing requirements can be found in 49 CFR §178.601(g).

For testing, substitution for the actual hazardous lading is permitted by 49 CFR §178.602©. Water can be used as a substitute liquid.

Per the requesting activity, an I.C.C. LTD brand locking ring was used as a secondary closure of the friction-lid can. In accordance with accepted packaging practice, filament-reinforced tape (medium tensile) was used as secondary closure of the screw-cap bottle.

A rubber mallet was used to tap the friction lid and plastic locking ring securely into place. Care must be exercised to avoid denting or creasing the friction-lid can. Sufficient "bubble" wrap must be used inside the friction-lid can to prevent any movement of the screw-cap bottle.

One combination packaging made to the above described configuration was subjected to drop and vibration testing as prescribed in ASTM D 4919. These tests are designed to simulate the shock and vibration a package (configuration) may encounter when being shipped worldwide by truck, rail, or ocean going transport. The order of testing was vibration, then drop testing. Prior to the rough handling testing of the packed box, static loading was performed on an empty box. This is a U.S. DOT approved method of stack testing, especially when the combination packaging has wide applications. A separate box was used for water absorptiveness testing of the fiberboard.

Appendix D (Continued)

In conducting the drop test, all five drops (flat bottom, flat top, flat long side, flat short side, and manufacturer's joint bottom corner) were performed on the same configuration. The decision to use the same container (configuration) for all five drop orientations was based on the relatively minimal damage demonstrated during previous testing of grade V3c, class weather-resistant, corrugated fiberboard boxes with different inner containers. It should be noted that five drops per box exceeds 49 CFR requirements. One drop per box is the minimum per 49 CFR requirements (49 CFR §178.603(a)), as well as, per both UN and ASTM recommendations (i.e., one drop on a side or corner per box). The use of one configuration for multiple tests and drops is DOD policy as stated in DLAD 4145.41/AR 700-143/AFJI 24-201/ NAVSUPINST 4030.55A/MCO 4030.40A, Packaging of Hazardous Material. Also per this policy, any failed orientation(s) can be repeated using another configuration.

Due to the variety of items to be packaged, testing was actually conducted according to the parameters for dense liquids (those with specific gravity up to 1.8) belonging to Packing Group II. This would equate to rough handling tests equivalent to those for Packing Group I for liquids having a specific gravity of 1.2 or less, and for Packing Group III liquids having specific gravity of 2.7 or less.

For the drop test (49 CFR §178.603), a free fall drop table, set for 1.8 meters (71 in.), was used. The impact surface was the ½-inch steel impact plate of the table, which was bolted to the concrete floor.

The leakproofness test of the metal, friction-lid can and the glass, screw-cap bottle (49 CFR §178.604) is not required, because the bottle is an inner packaging in a combination packaging.

For the stack test (49 CFR §178.606), a 500-lb steel plate was used because it could hold the load constant for the required 24-hour timeframe. The minimum total top load to be applied was computed based on the density of the heaviest liquid anticipated (SG = 2.7) at 98% of maximum capacity, and the outer box height. The top load was to simulate a stack of identical packagings which might be stacked on the packaging during transport. The minimum height of the stack could not be less than 3 meters (118 in.), so the number of packagings (stack height minimum divided by assembled box height) had to be represented by an integer number, which had to be rounded up, without respect to which was the nearest whole number.

Appendix D (Continued)

To be in compliance with U.S. Department of Transportation standards for packagings bearing the United States mark (USA) as a component of the packaging certification marking (49 CFR §173.24a(a)(5)), the vibration test (49 CFR §178.608) was performed, as a means to determine capability. The test was conducted as prescribed by ASTM D 999, method A2 (Repetitive Shock Test (Rotary Motion)). The test was run for 1 hour, using the box/can/water-filled bottle combination packaging. The combination packaging was tested using a 1,250-lb vibration table (rotary motion) that had a 1-inch-vertical double amplitude (peak-to-peak displacement) such that the combination packaging was raised from the platform to such a degree that a piece of steel strapping (1.6 mm) could be passed between the bottom of the package and the platform.

As required by the standards for fiberboard boxes (49 CFR §178.516), the Cobb Method Test for water absorptiveness was performed on ten specimens (125 mm by 125 mm) cut from one box taken from the same bundle as the box used for rough handling (drop, stack, and vibration) testing. This test was performed per TAPPI Method T 441.

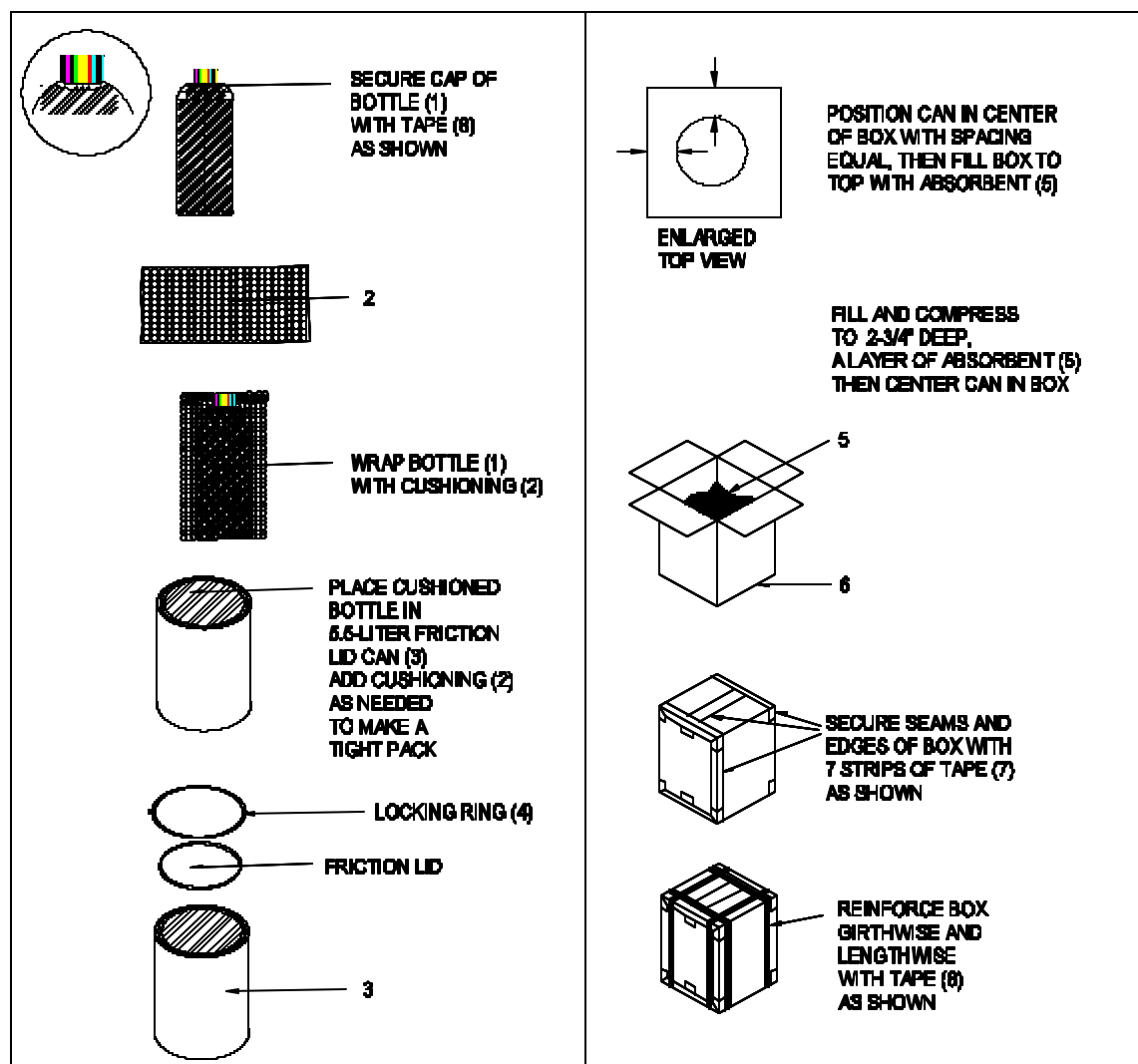
The apparatus used was a commercially available Cobb Sizing Tester.

The volume of deionized water was computed to maintain an equivalent head of 1.0 ± 0.1 centimeter. Since boxes are occasionally made with the wire facing (interior) as the exterior side of the box, specimens from both the wire (interior) and the felt (exterior) facings were tested for water absorptiveness. It should be noted that improper storage and rough handling can break the fibers and abrade the coating, decreasing the ability to resist water absorption. This could result in higher test values.

Compatibility testing (a procedure specified in appendix B to part 173, as required by 49 CFR §173.24(e)(3)(ii)) is only required for plastics packagings intended to contain liquid hazardous materials.

Appendix D (Continued)
Drawing

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ITEM	DESCRIPTION	0AYP028D
1	1-LITER, ROUND, SCREW CAP GLASS BOTTLE, QTY. 1	
2	BUBBLE WRAP, PFP-C-785, CLASS 1, 5/16"	
3	5.5 LITER FRICTION PLUG (LID) ROUND, METAL CAN, QTY. 1	
4	LOCKING RING-L.C.C. BRAND (NO SUBSTITUTION), P/N C-2	
5	CELLULOSE FIBER ABSORBENT, OR VERMICULITE, A-A-52460	
6	FIBERBOARD BOX, ASTM D6118, STYLE RSC, GRADE V3a, NSN: 8115-00-418-4863, 12X12X16 IN.	
7	2-INCH WIDE, PRESSURE-SENSITIVE TAPE, IAW ASTM D 5408, TY II, NSN: 7510-00-266-6715	
8	1-INCH WIDE, PRESSURE-SENSITIVE TAPE, FILAMENT-REINFORCED, IAW ASTM D6330, TY II	

